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A Model of Navy Surface Warfare Officer Retention

Kimberly A. Crayton (NPRST)
Kimberly Darling (SAG)
Patrick C. Mackin (SAG)

Navy Personnel Research, Studies, & Technology



Overview

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★ Problem

□ Objective

□ Methodology

□ Data

□ Findings

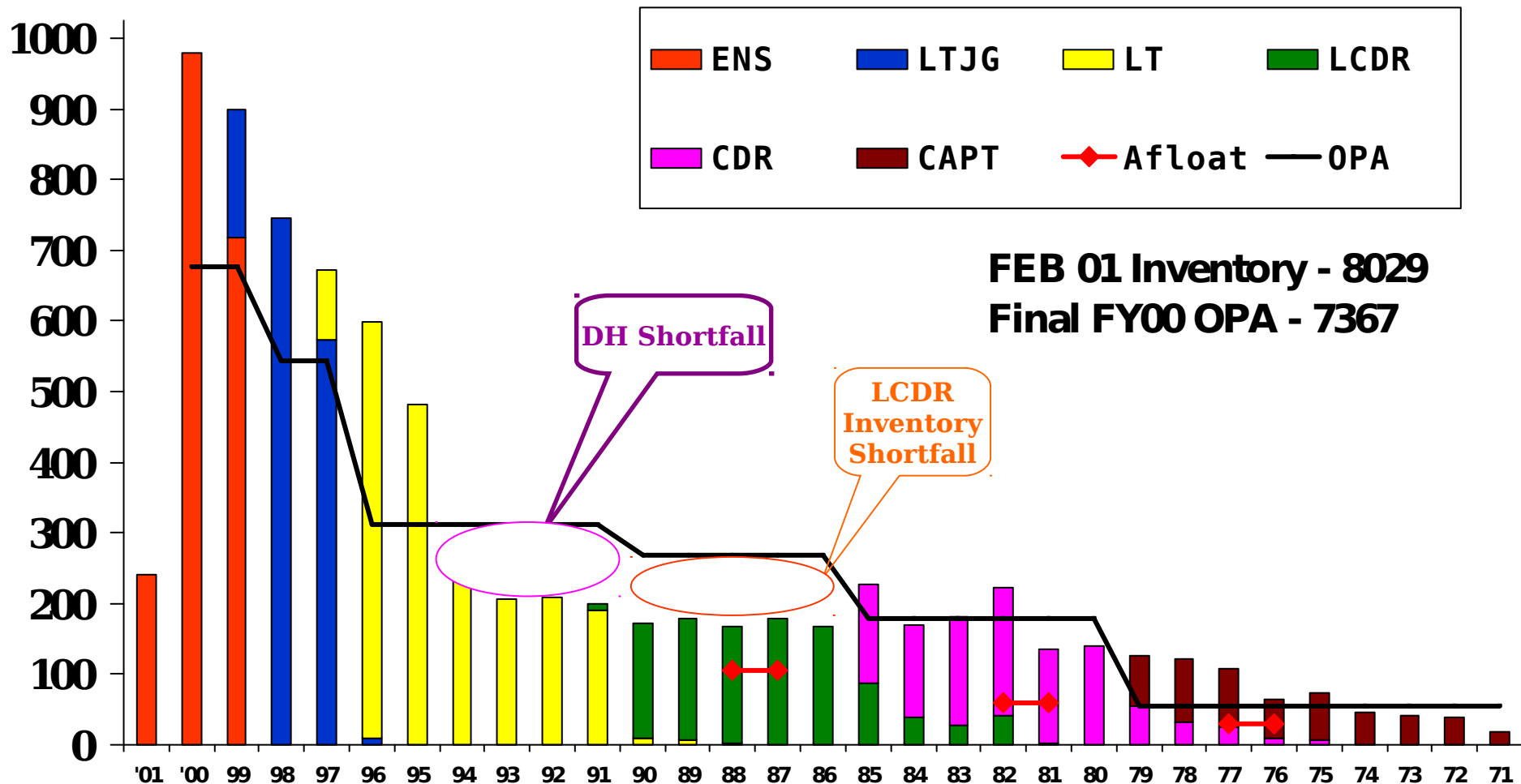
□ Conclusion

Operational Problem

- ★ **The Navy does not currently have an econometric model of the retention behavior of Surface Warfare Officers.**
- **There is a need to understand the impact of changes in pay and economic conditions on the shape of the Officer force.**
- **Enhance historic retention rates for out-year projections by incorporating exogenous economic factors into a model.**

Surface Warfare Officer Current Manning Profile

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Objective

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- ★ **Explore retention impact of recent changes in officer compensation (e.g., SWOCP)**
- ▢ **Investigate impact of Quality of Life and Quality of Work factors on retention**
 - **Unemployment**
 - **Demographic (gender, race, dependent status)**
 - **Service Effects (Academy, Naval ROTC, Prior Enlisted source of commission)**
 - **Working conditions (ship type, DH tour)**
- ▢ **Provide quantitative evidence for evaluating policy proposals**
- ▢ **Develop a plan to incorporate the behavior equations into an out-year projection model that monitors the officer force.**

Approach

- ★ **Develop and estimate a structural model of retention behavior**
 - **Probability that an officer chooses to stay in Navy depends on several factors**
 - Relative pay
 - “Taste” for the Navy
 - Working conditions (deployments, rotation frequency, family separation)
- **Estimate model for SWO officers from MSR through YOS 15**
 - Variable number of decisions points
- **Extend model to consider other factors affecting retention**
- **Overcome obstacles of including this model into a projection system**

Estimate a Model of Occupational Choice

Methodology

- ★ ACOL (Annualized Cost of Leaving)
 - $ACOL + \text{Mil \& Civ Alternative} > \text{Taste}$
 - Decision Rule: Stay if ACOL value exceeds net distaste for military
- Use Panel Probit (ACOL-2) framework
 - Heterogeneity
 - Dynamic Adjustments
 - Self-selection problem
- **Specification of civilian earnings**
- **Incorporating effects of working conditions**

Data

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- ▢ **Officer personnel data provided by NPRST**
- ▢ **Converted into panel data set for ACOL-2**
- ▢ **Sample consists of 14,020 Surface Warfare Officers (non-Nuclear) who made voluntary stay/leave decisions between CY 1979 and CY 2000**
- ▢ **Includes retention decisions from Minimum Service Requirement (MSR) through up to 7 annual decisions**
 - **Account for differences in MSR and for Grad Ed obligations**

Panel Data CY 1979 to CY 2000

Descriptive Statistics for Estimation Sample

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Dec. Point	No. of Observ.	Cont. Rate	Mean Values			
			ACOL	Unemp. Rate	YCS	Age
1	14,020	0.7181	5,813	6.4	4.8	28.8
2	9,105	0.8074	7,796	6.3	5.1	29.0
3	6,519	0.8187	9,247	6.1	6.4	30.2
4	4,758	0.8333	11,427	6.0	7.6	31.4
5	3,572	0.8676	15,938	5.9	8.8	32.7
6	2,765	0.8879	21,752	5.8	9.8	33.8
7	2,181	0.9367	26,292	5.8	10.7	34.7

Descriptive Statistics for Estimation Sample

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Proportion of Sample who were

Dec. Point	Naval Academy Grads	NROTC Grads	Prior Enlisted	Female	Nonwhite	With Dep.	College Grads
1	0.223	0.365	0.196	0.026	0.180	0.560	0.991
2	0.232	0.345	0.196	0.027	0.164	0.599	0.993
3	0.238	0.366	0.219	0.025	0.161	0.668	0.994
4	0.232	0.381	0.247	0.024	0.155	0.730	0.995
5	0.221	0.365	0.274	0.022	0.143	0.783	0.996
6	0.216	0.345	0.303	0.022	0.133	0.820	0.995
7	0.225	0.324	0.326	0.022	0.137	0.847	0.997

Results

- ★ **Estimation Model**
- **Estimation Results**
- **Pay Effects**
- **Unemployment Effects**
- **Demographic and Service Effects**



Estimation Model

- **Basic Model:**
 - **Unemployment rate (UNEMP)**
 - **ACOL**
- **Service Variables**
 - **ACAD, NROTC, and ENLIND**
- **Demographics**
 - **Female, Nonwhite, and Dependents**
- **Service and Demographics**

Results Stable Across All Four Specifications

Estimation Results

	Basic	Service	Demographics	Svr & Demo
Intercept	-0.092749*	0.024084	-0.138333	-0.024968
UNEMP	0.089005*	0.084693*	0.090643*	0.086381*
ACOL	0.000032*	0.000035*	0.000032*	0.000035*
FEMALE			0.362000*	0.362844*
NONWHITE			-0.135629*	-0.118782*
DEP			0.097964*	0.089796*
ACAD		-0.176109*		-0.170676*
NROTC		-0.219975*		-0.209472*
ENLIND		0.136166*		0.132911*
ρ	0.286839*	0.270910*	0.272109*	0.257812*
LR X^2	6,150.7 *	4,526.7*	7,083.1 *	5,341.8 *
Maddala's Pseudo R^2	0.3551	0.2759	0.3966	0.3168

* Significant at the .01 level

Pay Effects

Dec. Point	Simulated Pay Elasticity
1	0.748
2	0.525
3	0.401
4	0.246
5	0.138
6	0.133
7	0.098

- Pay elasticity of 0.748 at MSR
 - Effects decline with tenure
- SWOCP increases retention at MSR by 15%
- Typical Officer: white, male, NROTC graduate w/dependent

- Results consistent with other officer studies

Study	Service/Community	Pay Elasticities at MSR
Mackin, et. al. (1995)	Army OPMD Officers	0.198—0.599
Nakada, et. al. (1996)	Navy Nuclear Program Officers	0.489—0.611

Demographic and Service Effects

Variable	Perc. Change in Retention
FEMALE	9.35
NONWHITE	-3.73
No Deps.	-2.80
ACADEMY	1.15
OCS	5.78
ENLIND	3.79

- ★ Female officers were more likely to stay than males & nonwhites
- ▢ Officers w/dependents have higher retention likelihood
- ▢ OCS grads stay at highest rates, NROTC at lowest
- ▢ Officers w/prior enlisted service more likely to stay
 - Even adjusting for pay

Descriptive Statistic for OCS Sample

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Dec. Point	No. of Observ.	Cont. Rate	Mean Values			
			ACOL	Unemp. Rate	YCS	Age
1	5,223	0.7679	7,014	6.3	4.4	30.5
2	3,521	0.7989	8,808	6.4	4.1	29.7
3	2,354	0.8352	11,034	6.3	5.3	30.9
4	1,669	0.8850	13,199	6.2	6.6	32.3
5	1,335	0.8816	18,819	6.0	7.7	33.5
6	1,087	0.8638	27,597	5.9	98.9	34.7
7	882	0.9252	34,389	5.9	9.9	35.8

Results From Department Head Tour Length

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	Service and Demographic Variables	Add Measures of Change in DH Tour Length
Intercept	-0.024968	-0.073219**
UNEMP	0.086381*	0.091624*
ACOL	0.000035*	0.000034*
FEMALE	0.362844*	0.358629*
NONWHITE	-0.118782*	-0.070885*
DEP	0.089796*	0.086273*
ACAD	-0.170676*	0.137182*
NROTC	-0.209472*	-0.207164*
ENLIND	0.132911*	0.137182*
DHLEN		-0.040234*
ρ	0.257812*	0.255838*
LR Chi-Squared	5,341.8 *	6192.2*
Maddala's Pseudo R^2	0.3168	0.3570

- Effects are negative and Significant
- Estimates are stable and overall goodness of fit improves

DH Tour Length Simulated Change

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Dec. Point	Simulated DHTour Length
1	-5.18
2	-3.50
3	-2.48
4	-1.74
5	-1.38
6	-1.11
7	-0.70

- Four month increase leads to more than 5% decrease in retention
- Implication on managing URL in general
- These results used to predict retention when tour lengths increase
- Determine incentive pay to offset unavoidable increases in tour length

Conclusion

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- ★ **Using Panel Probit framework could control for unobserved heterogeneity**
- ▢ **SWO's demonstrated a significant positive relationship between military pay and retention**
- ▢ **New career pay increases retention probabilities at MSR by over 15%**
- ▢ **Females and whites were more likely to stay than simular males and nonwhites.**
- ▢ **Officer w/dependents more likely to stay than single officers**
- ▢ **Prior enlisted more likely to stay than NROTC or Academy Grads**
- ▢ **Changes in DH Tour Length negatively related and Ship Type had no significant effect on retention**

Backup Slides

Econometric Adjustment of Loss Rates

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- ★ **The estimation results have immediate application in allowing planners to adjust loss projections to account for changes in pay and economic conditions**
- ▮ **The adjustment of loss rates will be based on changes in the predicted value of the financial variable (ACOL) and on changes in the unemployment rate**
- ▮ **Increase both data and user interface requirements to specify changes from base to the projection period**

Results From OCS Sample w/Ship Type

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- ★ **OCS Sample Older**
- ▢ **More Females and Fewer College Graduates**
- ▢ **Average ACOL at any given decision point is higher**
- ▢ **Over half of initial assignments are:**
 - **DDG's, Cruisers, Destroyers, Frigates**
- ▢ **All of the coefficients are either insignificant or only slightly significant.**
- ▢ **Parameter estimates changed when including these variables.**
- ▢ **Goodness of fit as LR Chi-Squared and Maddala's Pseudo R^2 was also reduced**
- ▢ **Therefore, division officer ship assignments (as measured here) do not appear to affect retention behavior.**

Results From DH Tour Length

- ★ **Assumed officers began their department head sequence at YCS 7**
- **The community manager generated the average department head tour length by year group.**
- **Average tour length varied from a high of 46.3 months for YG 1976 to a low of 36 months for YG 1992.**
- **Effects are negative and significant implying an increase in DH Tour Length cause a decrease in retention**
- **Estimates are stable and overall goodness of fit improves**